CLAIMS TO INVENTION:

1. A object attribute acquisition and analysis system completely contained within in a single housing of compact lightweight construction .

2. An object attribute acquisition and analysis system, which is capable of (1) acquiring and analyzing in real-time the physical attributes of objects such as, for example, (i) the surface reflectively characteristics of objects, (ii) geometrical characteristics of objects, including shape measurement, (iii) the motion (i.e. trajectory) and velocity of objects, as well as (iv) bar code symbol, textual, and other information-bearing structures disposed thereon, and (2) generating information structures representative thereof for use in diverse applications including, for example, object identification, tracking, and/or transportation/routing operations.

3. An object attribute acquisition and analysis system, wherein a multi-wavelength i.e. color-sensitive) Laser Doppler Imaging and Profiling (LDIP) subsystem is provided for acquiring and analyzing (in real-time) the physical attributes of objects such as, for example, (i) the surface reflectively characteristics of objects, (ii) geometrical characteristics of objects, including shape measurement, and (iii) the motion (i.e. trajectory) and velocity of objects.

4. An object attribute acquisition and analysis system, wherein an image formation and detection (i.e. camera) subsystem is provided having (i) a planar laser illumination and monochromatic imaging (PLIIM) subsystem, (ii) intelligent auto-focus/auto-zoom imaging optics, and (iii) a high-speed electronic image detection array with height/velocity-driven photo-integration time control to ensure the capture of images having constant image resolution (i.e. constant dpi) independent of package height.

5. An object attribute acquisition and analysis system, wherein an advanced image-based bar code symbol decoder is provided for reading 1-D and 2-D bar code symbol labels on objects, and an advanced optical character recognition (OCR) processor is provided for reading textual information, such as alphanumeric character strings, representative within digital images that have been captured and lifted from the system.

6 An object attribute acquisition and analysis system for use in the high-speed parcel, postal and material handling industries.

7. An object attribute acquisition and analysis system, which is capable of being used to identify, track and route packages, as well as identify individuals for security and personnel control applications.

8. An object attribute acquisition and analysis system which enables bar code symbol reading of linear and two-dimensional bar codes, OCR-compatible image lifting, dimensioning,

singulation, object (e.g. package) position and velocity measurement, and label-to-parcel tracking from a single overhead-mounted housing measuring one 20" x 20" x 8".

9. An object attribute acquisition and analysis system which employs a built-in source for producing a planar laser illumination beam that is coplanar with the field of view of the imaging optics used to form images on an electronic image detection array, thereby eliminating the need for large, complex, high-power power consuming sodium vapor lighting equipment used in conjunction with most industrial CCD cameras.

10. An object attribute acquisition and analysis system, wherein the all-in-one (i.e. unitary) construction simplifies installation, connectivity, and reliability for customers as it utilizes a single input cable for supplying input (AC) power and a single output cable for outputting digital data to host systems.

11. An object attribute acquisition and analysis system, wherein such systems can be configured to construct multi-sided tunnel-type imaging systems, used in airline baggage handling systems, as well as in postal and parcel identification, dimensioning and sortation systems.

12. An object attribute acquisition and analysis system, for use in (i) automatic checkout solutions installed within retail shopping environments (e.g. supermarkets), (ii) security and people analysis applications, (iii) object and/or material identification and inspection systems. as well as (iv) diverse portable, in-counter and fixed applications in virtual any industry.

13. An object attribute acquisition and analysis system in the form of a high-speed package dimensioning and identification system, wherein the PLIIM subsystem projects a field of view through a first light transmission aperture formed in the system housing, and a pair of planar laser illumination beams through second and third light transmission apertures which are optically isolated from the first light transmission aperture to prevent laser beam scattering within the housing of the system, and the LDIP subsystem projects a pair of laser beams at different angles through a fourth light transmission aperture.

14. An automated unitary-type package identification and measuring system (i.e. contained within a single housing or enclosure), wherein a PLIIM-based scanning subsystem is used to read bar codes on packages passing below or near the system, while a package dimensioning subsystem is used to capture information about the package prior to being identified.

15. An automated package identification and measuring system, wherein Laser Detecting And Ranging (LADAR-based) scanning methods are used to capture two-dimensional range data maps of the space above a conveyor belt structure, and two-dimensional image contour tracing methods are used to extract package dimension data therefrom.

16. A PLIM which embodies an optical technique that effectively destroys the spatial and or temporal coherence of the laser illumination sources that are used to generate planar laser illumination beams (PLIBs) within PLIIM-based systems.

17. A PLIM, wherein the spatial coherence of the illumination sources is destroyed by creating multiple "virtual" illumination sources that illuminate the object at different angles, over the photo-integration time period of the electronic image detection array used in the IFD module.

18. A PLIM which embodies an optical technique that effectively reduces speckle-noise pattern at an image detection array by destroying the spatial and/or temporal coherence of the laser illumination sources are used to generate planar laser illumination beams (PLIBs) within the PLIIM-based system.

19. A PLIM, wherein the spatial coherence of the illumination sources is destroyed by creating multiple "virtual" illumination sources that illuminate the object at different points in space, over the photo-integration time period of the electronic image detection array used in the system.

20. A method and apparatus, wherein the individual beam components within the composite planar laser illumination beam are (i) micro-oscillated (i.e. moved) along the planar extent thereof by an amount of distance Δx which is sufficient to cause a difference in phase among the wavefronts of the individual beam component by an amount on the order of 1/2 of the laser illumination wavelength, and (ii) at a rate of change which is greater than or equal to the inverse of the photo-integration time period of the detector elements. Under such conditions, the target object is repeatedly illuminated with laser light apparently originating from different points in space over the photo-integration period of each detector element in the linear image detection array of the PLIIM system, during which reflected laser illumination is received at the detector element. As the relative phase delays between these virtual illumination sources are changing over the photo-integration time period of each image detection element, these virtual sources are effectively rendered spatially incoherent with each other. On a time-average basis, the coherent addition of laser illumination from such moving virtual illumination sources, causes a change in the illumination field detected at each image detection element in the IFD module. This destroys the spatial coherence of the laser illumination beam received at the detector elements and thereby reduces the speckle-noise pattern (i.e. level) produced thereat. As speckle noise patterns are roughly uncorrelated at the image detector, the reduction in speckle noise amplitude should be proportional to the square root of the number of independent virtual laser illumination sources contributing to the illumination of the target object and formation of the image frame thereof.

21. A PLIM, wherein the "temporal" coherence of the illumination sources is destroyed by creating multiple "virtual" illumination sources that illuminate the object at different moments in time, over the photo-integration time period of the electronic image detection array used in the system.

22. A method and apparatus, wherein (i) the wavefront of each individual beam component within the composite planar laser illumination beam is either amplitude modulated (AM) at a depth of modulation Δm (for case of AM), frequency modulated (FM) by an amount of frequency shift Δf (for the case of FM) or phase modulated (PM) by an amount of phase shift $\Delta\phi$ (for the case of PM) which is sufficient to cause a different in phase among the wavefronts of the individual beam component by an amount on the order of 1/2 of the laser illumination wavelength, and (ii) wherein the rate of change in such wavefront modulation is greater than or equal to the inverse of the photo-integration time period of the detector elements, thereby repeatedly illuminating the target object with laser light apparently originating at different moments in time over the photo-integration period of each detector element in the linear image detection array of the PLIIM system, during which reflected laser illumination is received at the detector element, thereby destroying the temporal coherence of the laser illumination beam received at the detector element and reducing the speckle-noise pattern (i.e. level) produced thereat.

23. A PLIIM-based package dimensioning and identification system, wherein the various information signals are generated by the LDIP subsystem, and provided to the Camera Control (Computer) Subsystem, and wherein the Camera Control Computer generates digital camera control signals which are provided to the image formation and detection (IFD subsystem (i.e. "camera") so that the system can carry out its diverse functions in an integrated manner, including (1) capturing digital images having (i) square pixels (i.e. 1:1 aspect ratio) independent of package height or velocity, (ii) significantly reduced speckle-noise levels, and (iii) constant image resolution measured in dots per inch (DPI) independent of package height or velocity and without the use of costly telecentric optics employed by prior art systems, (2) automatic cropping of captured images so that only regions of interest reflecting the package or package label are transmitted to either a image-processing based 1-D or 2-D bar code symbol decoder or an optical character recognition (OCR) image processor, and (3) automatic image lifting operations.